

Demonstration of AIRS Total Ozone Products in Operations to Enhance User Readiness

Emily Berndt¹, Bradley Zavodsky², Gary Jedlovec²

¹NASA Postdoctoral Program Marshall Space Flight Center, Huntsville, Alabama

²Short-term Prediction Research and Transition Center NASA/MSFC, Huntsville, Alabama



GOES-R Virtual Science Seminar
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Outline

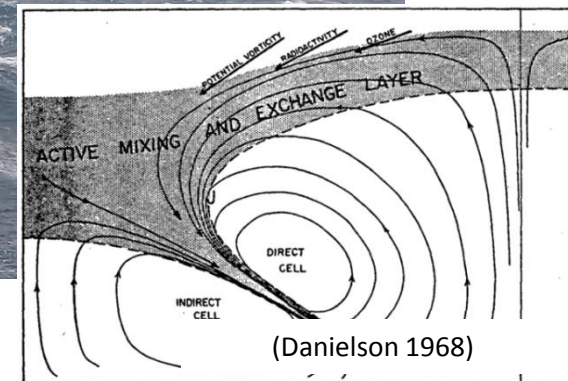
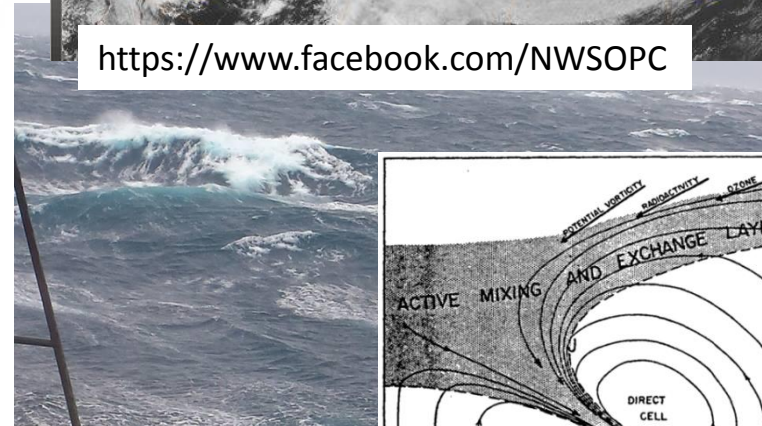
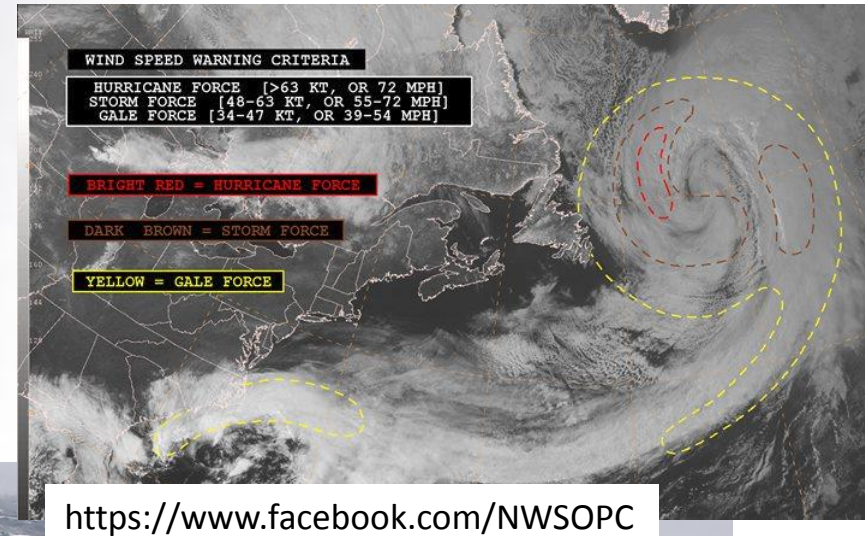
- Forecast Challenge & Ozone Retrievals
- Ozone Products
- Transition to National Centers
- New Product Development & Future Goals
- Further Air Mass RGB Validation

The objective of this presentation is to:

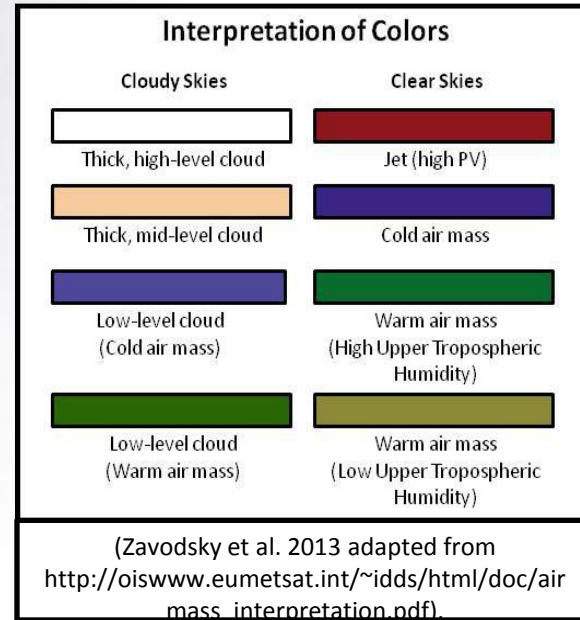
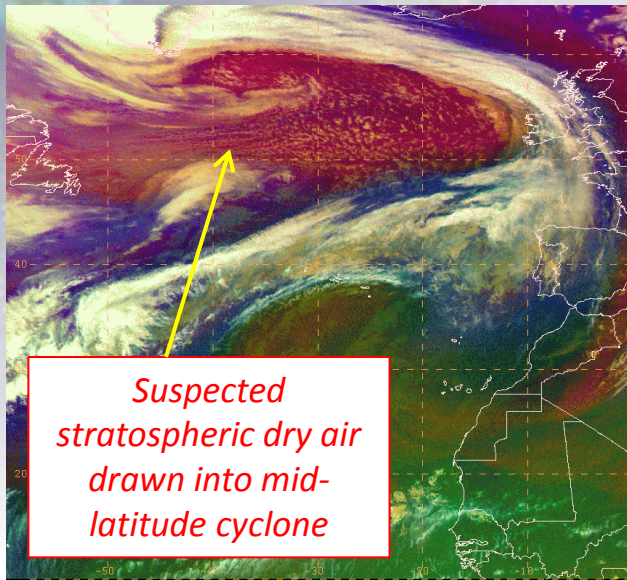
- *show work that SPoRT has done to transition AIRS ozone retrievals in preparation for advanced sounder instruments on operational NOAA satellites (i.e., CrIS)*
- *help forecasters with interpretation of Air Mass RGB imagery that is currently available from SEVIRI and will be available from GOES-R ABI*

Forecast Challenge & Ozone Retrievals

- WPC & OPC are tasked with providing outlooks that involve forecasting the development of synoptic scale systems and associated severe weather
- OPC especially focuses on forecasting cyclogenesis and the development of hurricane-force winds in the North Pacific and Atlantic oceans
- Identifying regions of stratospheric air and the potential for tropopause folding can enhance forecaster situational awareness of impending cyclogenesis and high wind events
- Stratospheric air can be identified by potential vorticity and warm, dry, ozone rich air

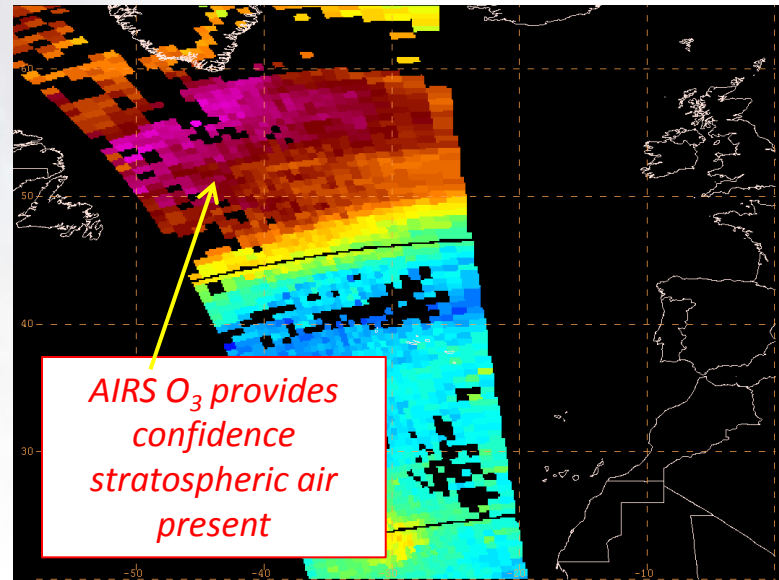
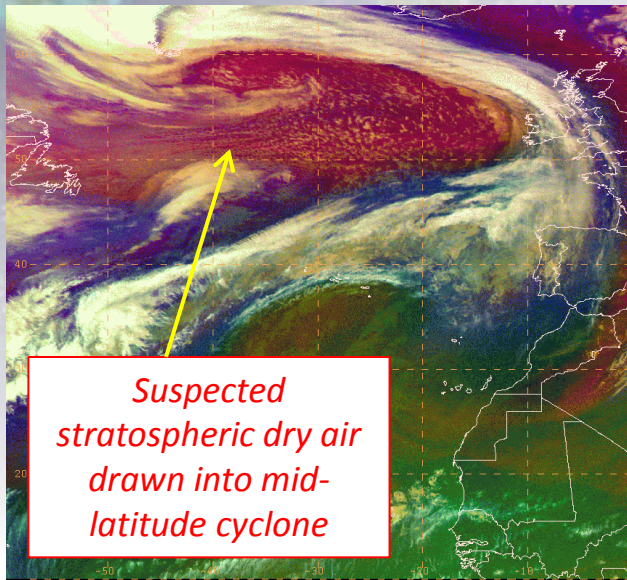


Forecast Challenge & Ozone Retrievals



- OPC has used the SEVIRI, MODIS, and GOES Sounder Air Mass RGB products as a proxy to prepare for GOES-R ABI capabilities
- Regions of red/orange coloring can indicate stratospheric air and the potential for tropopause folding, enhanced cyclogenesis and associated hurricane-force wind events
- Forecasters and product developers have expressed a need for quantitative products to enhance understanding and training of the qualitative RGB

Forecast Challenge & Ozone Retrievals



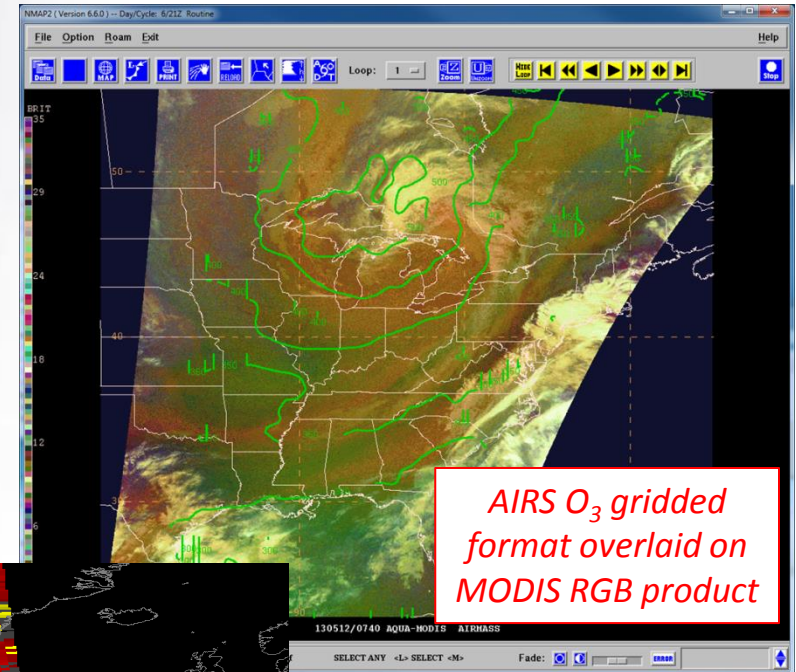
- SPoRT has worked closely with the GOES-R and JPSS Proving Grounds to develop and transition ozone products in N-AWIPS format to OPC for identification of stratospheric air/tropopause folds that lead to cyclogenesis and high wind events
- Legacy AIRS ozone retrievals can be used to enhance interpretation and increase forecaster confidence in the Air Mass RGB before GOES-R launch as well as demonstrate capabilities of next-generation JPSS CrIS retrievals

Outline

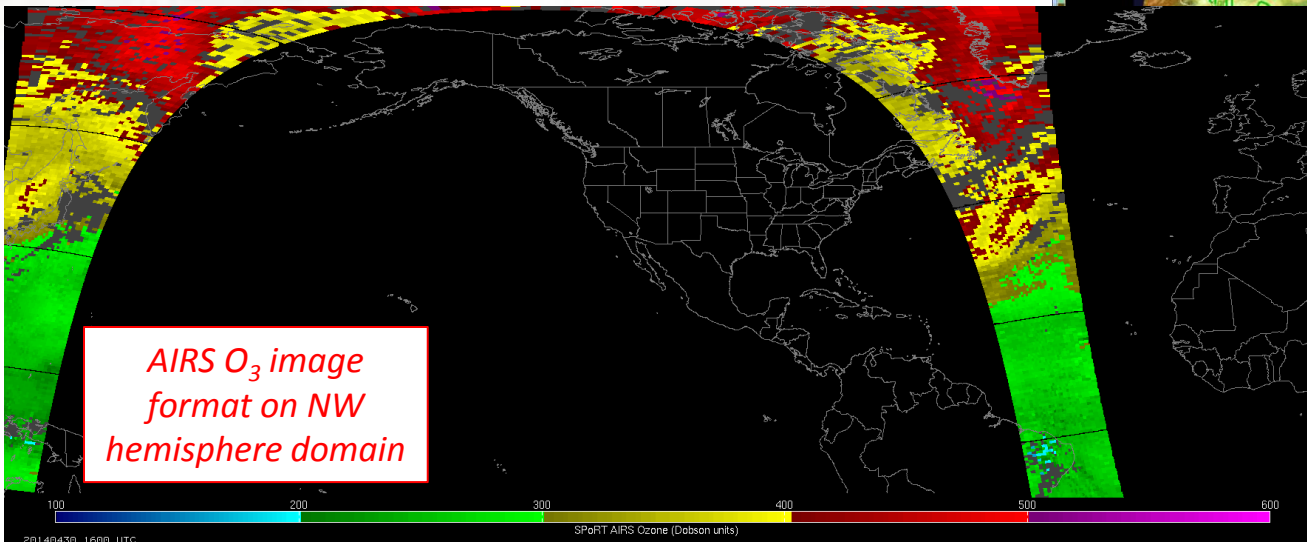
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What products does SPoRT create?

- SPoRT produces 2 products in image and gridded format:
 - Total Column Ozone
 - Ozone Anomaly
- AIRS data obtained from NASA Land Atmosphere Near Real-time Capability for EOS (LANCER) with latency between 60 and 200 minutes

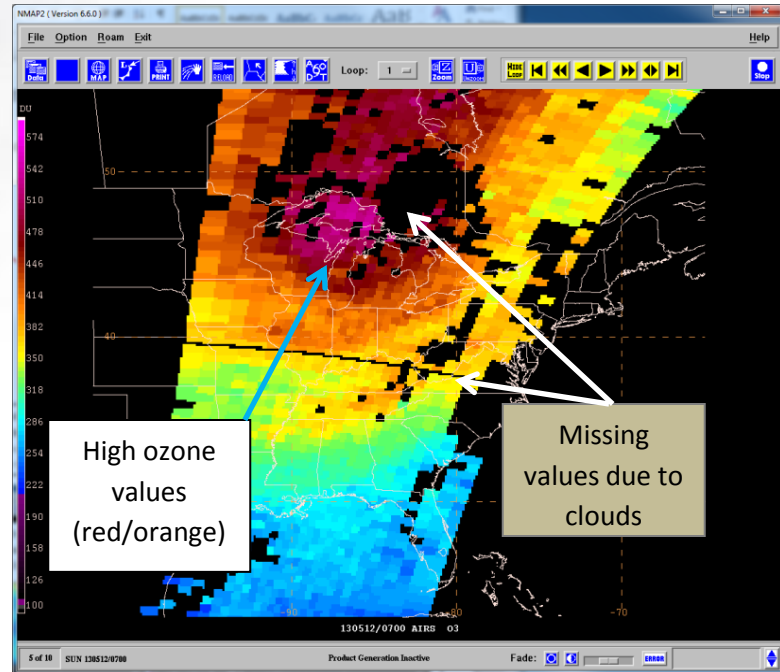
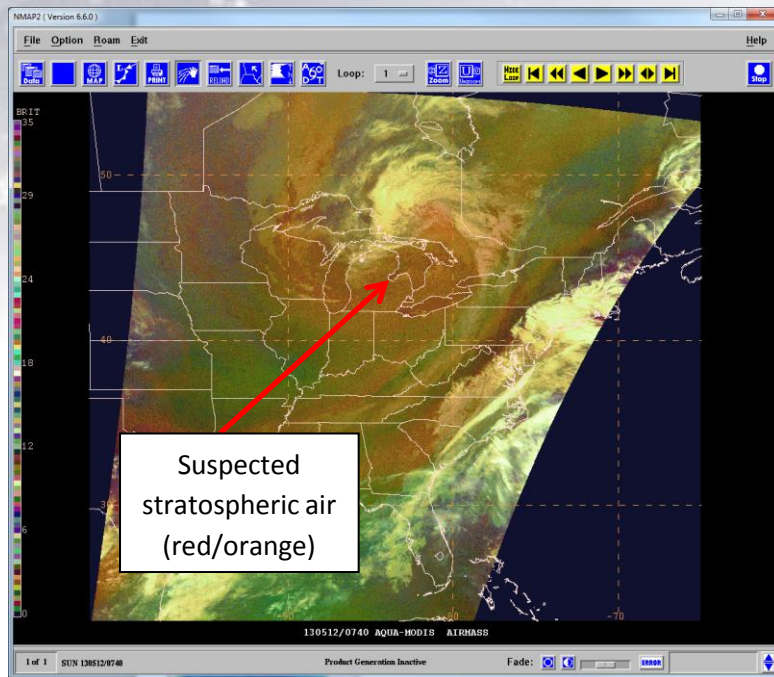


- Product is provided in hourly swaths:
 - Products have a 4-hour latency to utilize all granules
 - Advantage is hemispheric coverage for OPC's domain



Example 12 May 2013

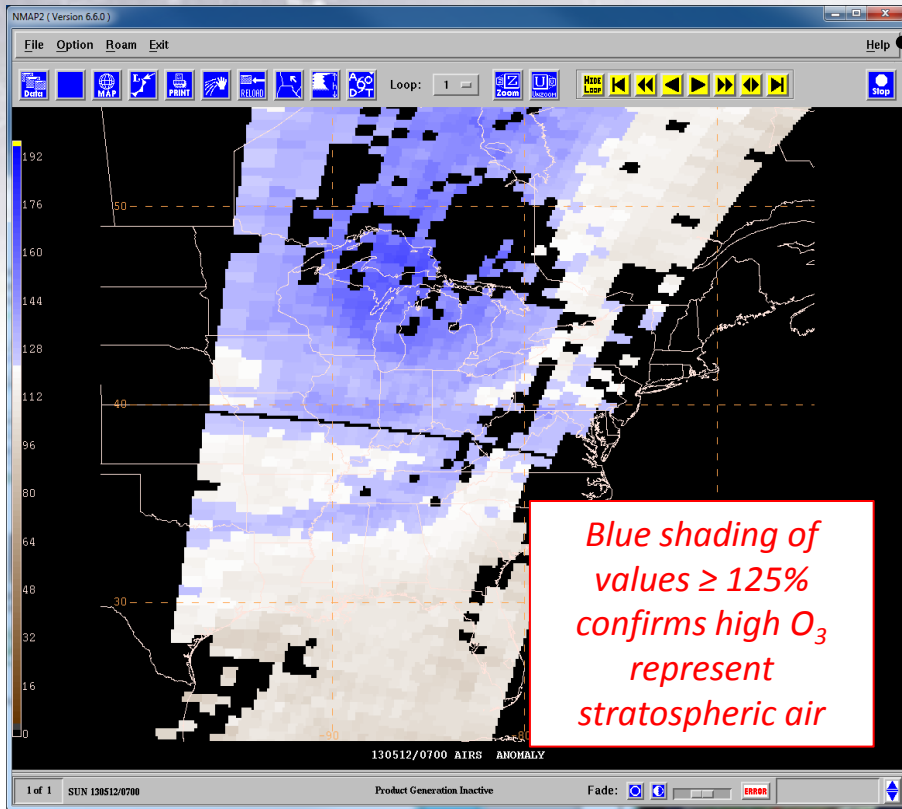
- SPoRT MODIS RGB Air Mass Image shows a region of red/orange coloring surrounding the low pressure center
- AIRS Total Column Ozone confirms there are high zone values in the region



- How do we know if these high ozone values represent stratospheric air or are within the climatological range?

Ozone Anomaly Product

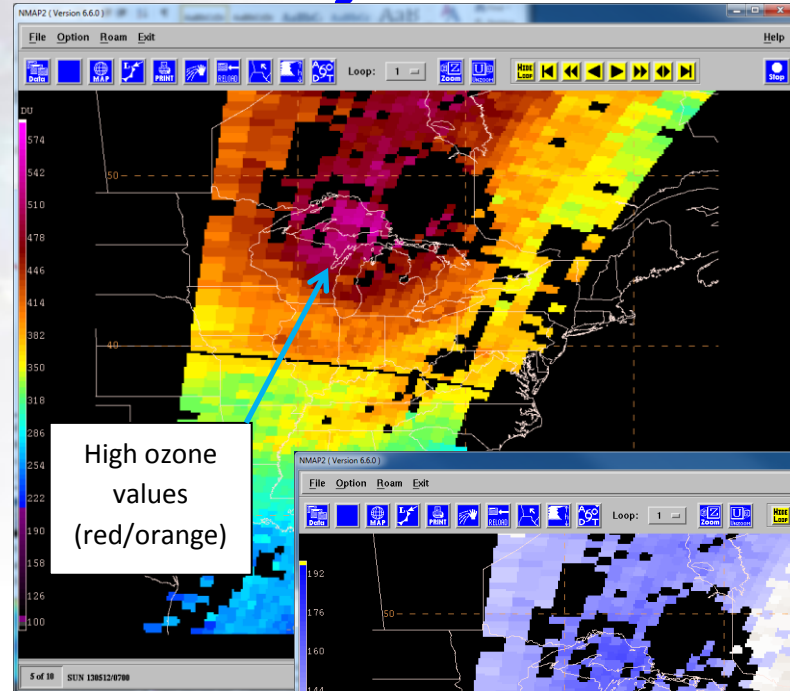
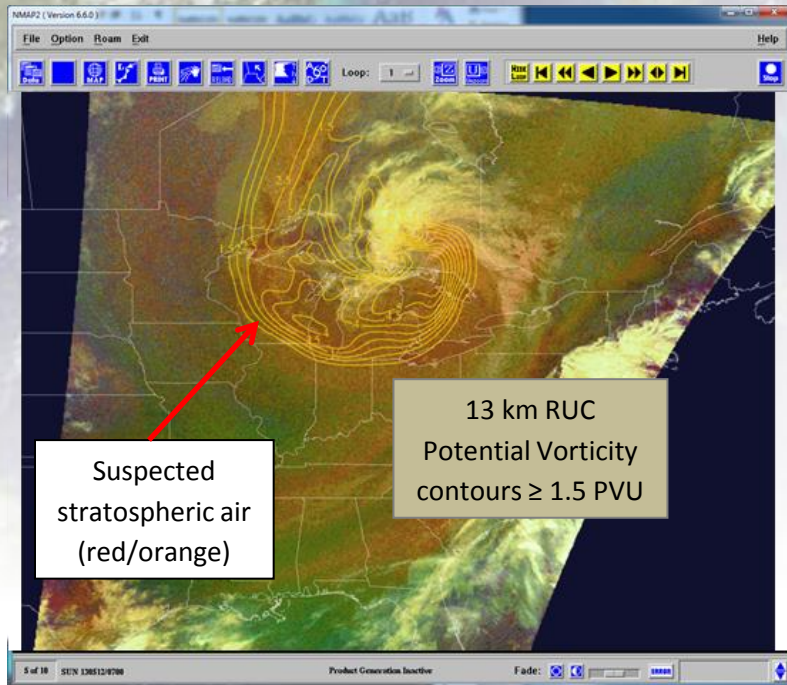
- Identification of stratospheric air based on high ozone values could lead to misinterpretation if the values actually range within climatology since the mean varies seasonally and spatially



The AIRS Ozone Anomaly product clarifies the presence of stratospheric air based on:

- Stratospheric air has ozone values at least 25% larger than the climatological mean (Van Haver et al. 1996)
- Global and zonal monthly mean climatology of stratospheric ozone derived from the NASA Microwave Limb Sounder (Ziemke et al. 2011)

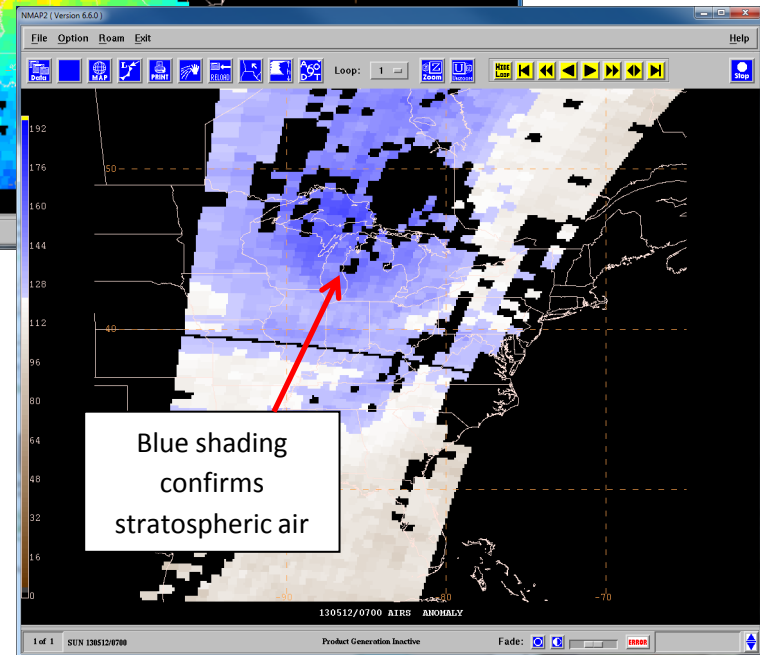
Example 12 May 2013



- SPoRT AIRS Ozone Anomaly product created as a percent of normal (0-200%)

$$PON = \frac{TCO}{climo} \times 100$$

- Shades of blue represent stratospheric air (ozone values $\geq 125\%$)

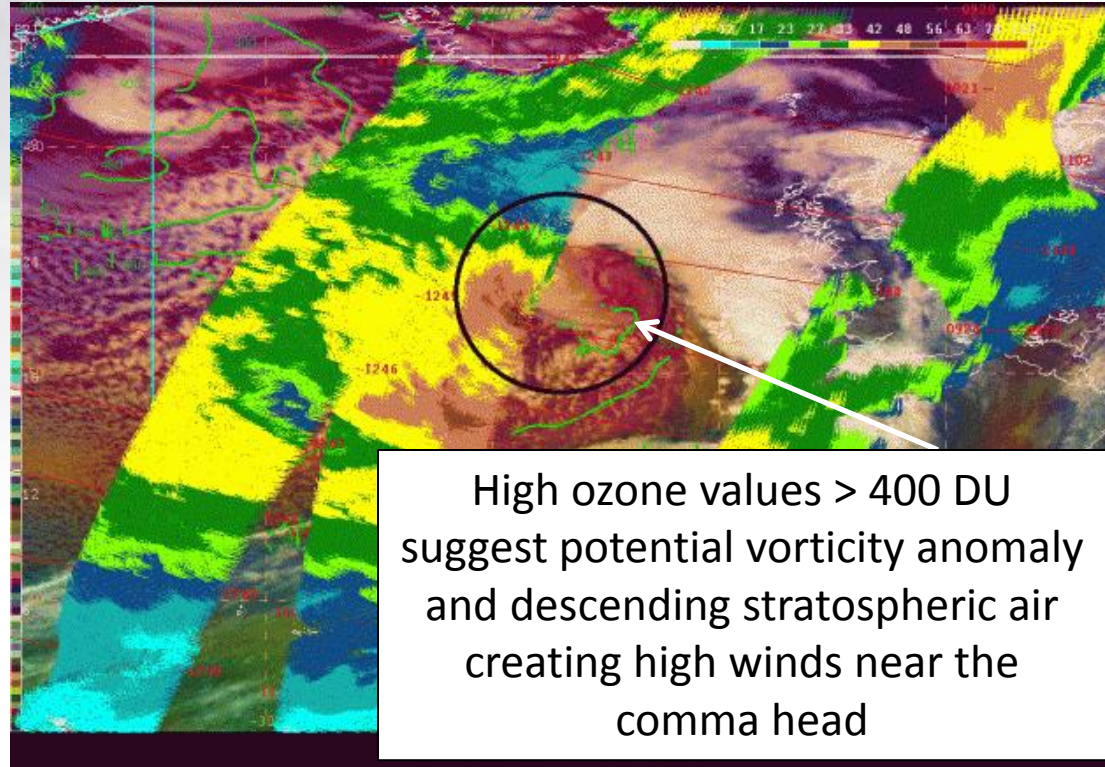


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- **Transition to National Centers**
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Transition to National Centers

- AIRS ozone products evaluated at OPC, WPC, SAB winter 2013-2014
- Forecaster Feedback
 - “Reinforce the evidence from RGB of the descent of stratospheric air with tropopause folding.”
 - “This has allowed me to have confidence in assessing the RGB Airmass product and also in conjunction with gridded GFS output that a perceived PV anomaly is real or not.”



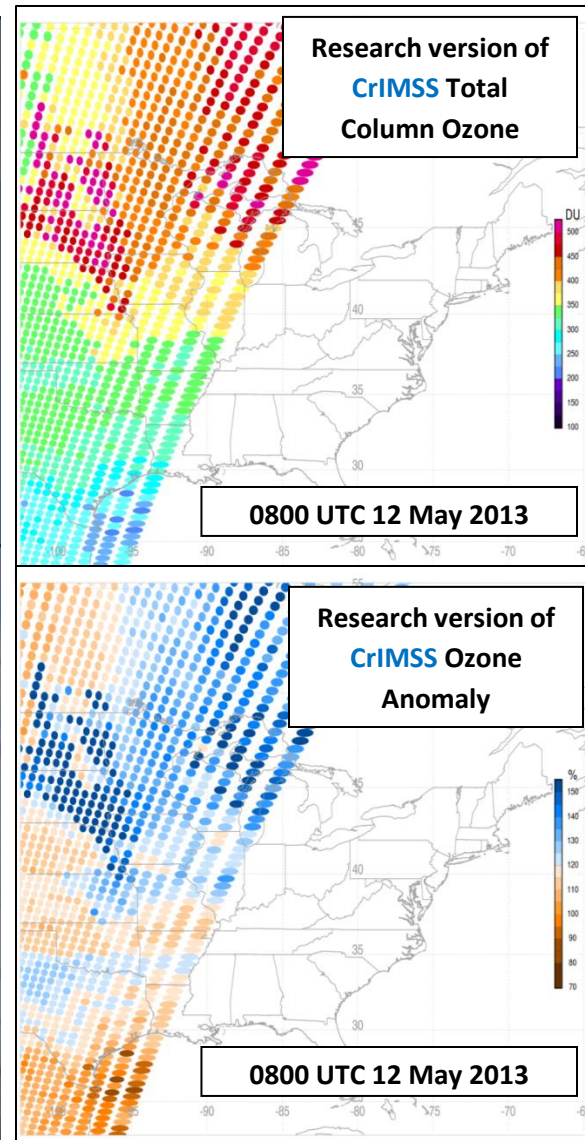
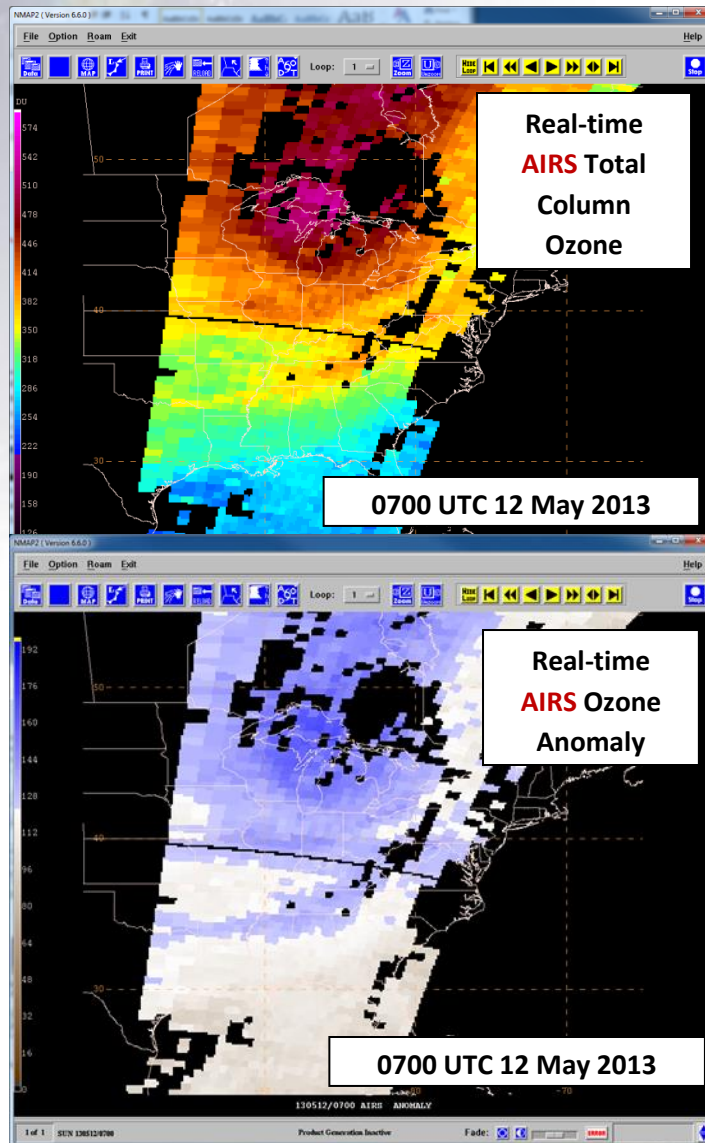
SEVIRI RGB Air Mass image, AIRS Total Column Ozone (green contours), and ASCAT winds valid at 1400 UTC on 12/18/13. The black circle highlights the descending stratospheric intrusion near the comma-head/bent back front. Image courtesy of Michael Folmer Satellite Liaison at NOAA/NWS WPC/OPC/TAFB and NOAA/NESDIS SAB

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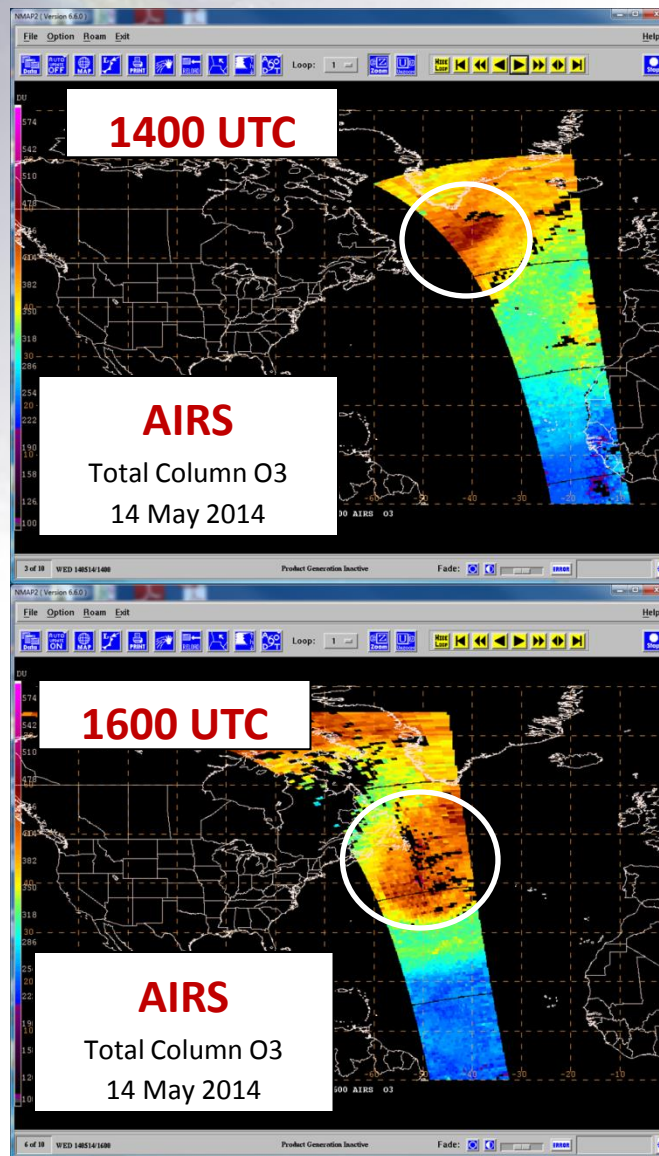
CrIMSS Ozone Products

- Expanding suite of ozone products to include CrIS
- Initial use of CrIMSS until NUCAPS CrIS is available
- Data obtained from SSEC PEATE server at an 8-hour latency to produce hourly swaths on a hemispheric domain
- NUCAPS CrIS ozone retrievals will be transitioned to OPC Fall 2014



CrIMSS Ozone Products

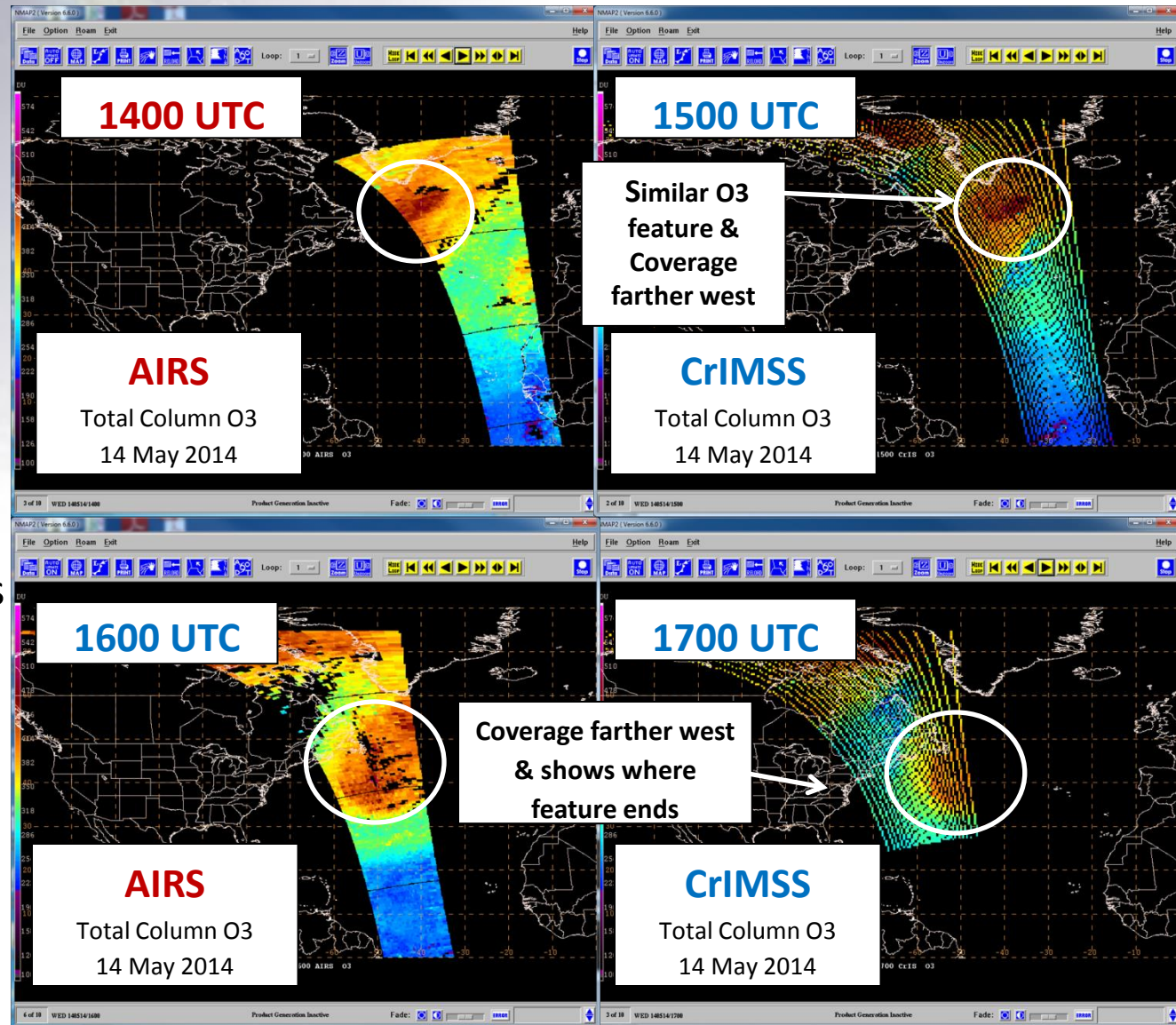
- Will including CrIMSS increase temporal and spatial coverage compared to using only AIRS?



Transitioning unique data and research technologies to operations

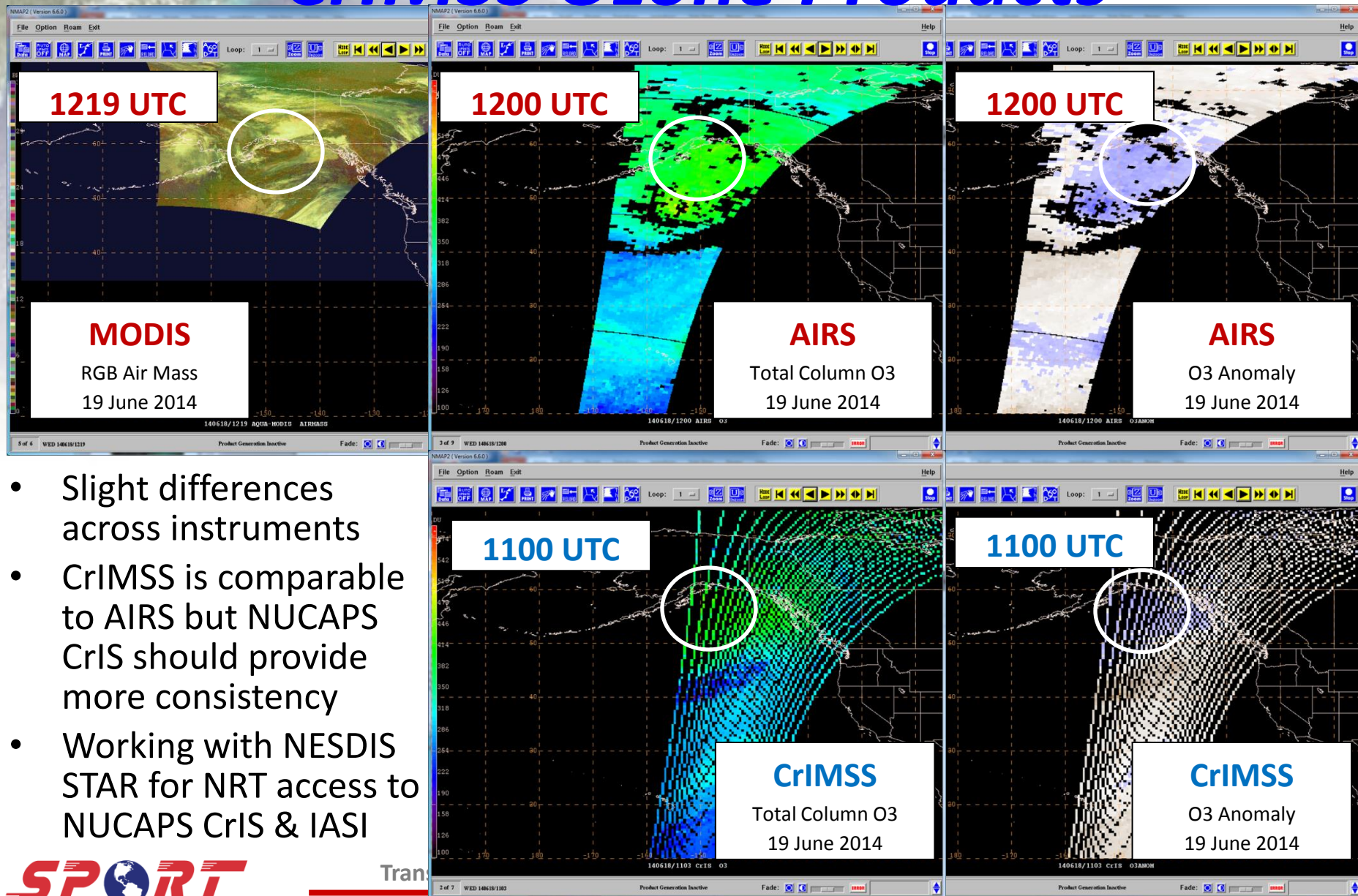
CrIMSS Ozone Products

- A forecaster could potentially loop through 4 consecutive time periods of data
- Demonstrates increased temporal coverage available from GOES-R ABI
- Spatial coverage over the 4 hour period now includes most of the North Atlantic
- Differing latencies still problematic (ie. Wouldn't see all these products until 0100 UTC)
- Need to refine the display of CrIMSS to match AIRS



Transitioning unique data and research technologies to operations

CrIMSS Ozone Products



- Slight differences across instruments
- CrIMSS is comparable to AIRS but NUCAPS CrIS should provide more consistency
- Working with NESDIS STAR for NRT access to NUCAPS CrIS & IASI

Future Goals

- Current training includes a quick guide
 - expand forecaster training to include a short module
- Make the products available in AWIPS-II
 - Currently funded joint SPoRT/CIRA/CIMSS GOES-R visiting scientist project to explore products in National Centers Perspective AWIPS-II

SPoRT

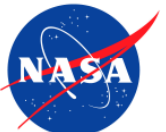
“There may have been 1 occasion where 1 pass did line up over the US with the spot I was interested in. In that case, it was helpful in reaffirming my suspicions on whether stratospheric air was present. Otherwise, the passes were few and far between and not particularly timely. If there was greater coverage of passes and not as much of a lag, it would certainly be useful.”

near the Great Lakes in the Air Mass RGB Imagery (top left) indicate stratospheric air and high potential vorticity near a jet streak. High potential vorticity values at 0800 UTC in the 500-300 mb layer correlate with the stratospheric air on the Air Mass RGB Imagery. The top right diagram shows high values of ozone over the Great Lakes region at 0700 UTC. The Ozone Anomaly product (bottom left) shows the high ozone values are a significant enough deviation from climatology to be considered stratospheric air. Non-convective high winds tend to occur under the region of stratospheric air. ASCAT measured winds ranging from 52-64 knots (27-33 m/s) over western Lake Erie and 33-52 knots (17-33 m/s) over Lake Huron (bottom right).

- Adjust product according to forecaster feedback after the winter demonstration at OPC
- Expand the ozone products to other instruments
 - Increase temporal & spatial coverage with AIRS, IASI, CrIS retrievals once NUCAPS is available
 - Work with NESDIS STAR to generate anomalies from their TOAST/TACO products which combine UV/IR ozone retrievals



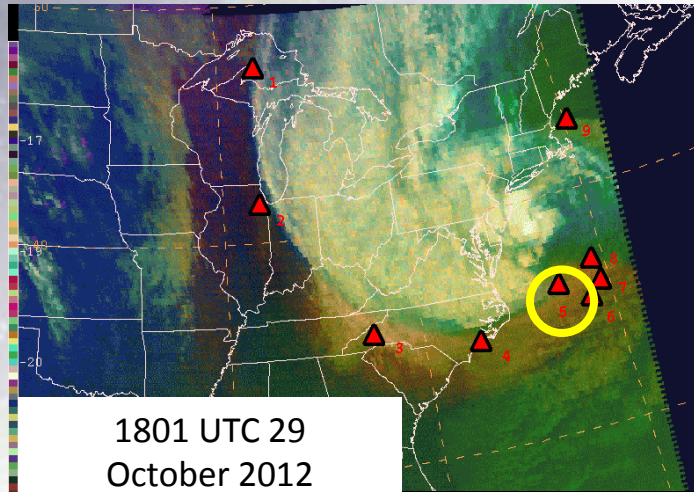
Transitioning unique data and research technologies to operations



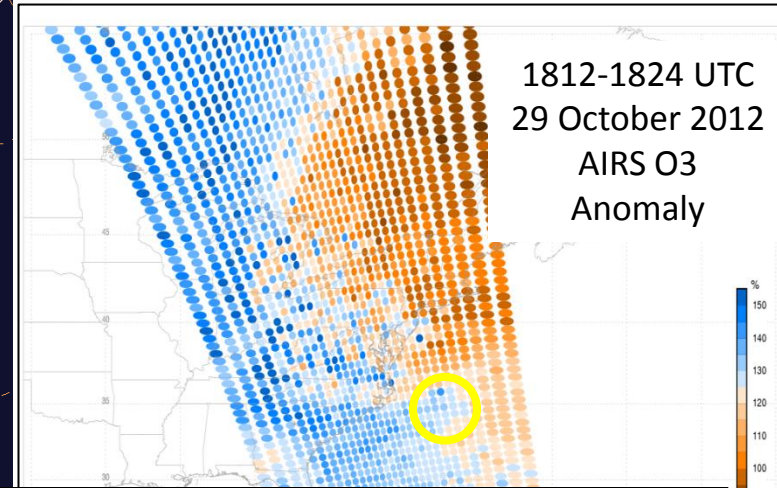
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Further Air Mass RGB Validation

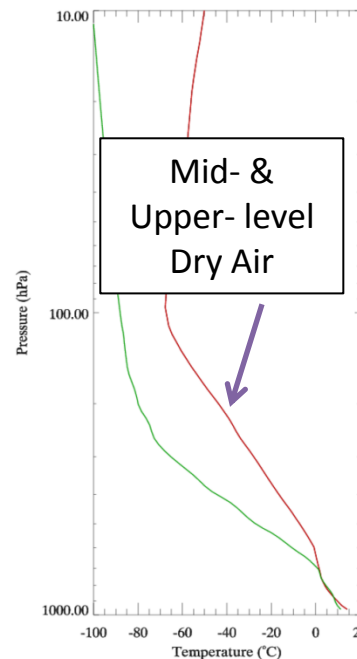


1801 UTC 29
October 2012
GOES Sounder
Air Mass RGB

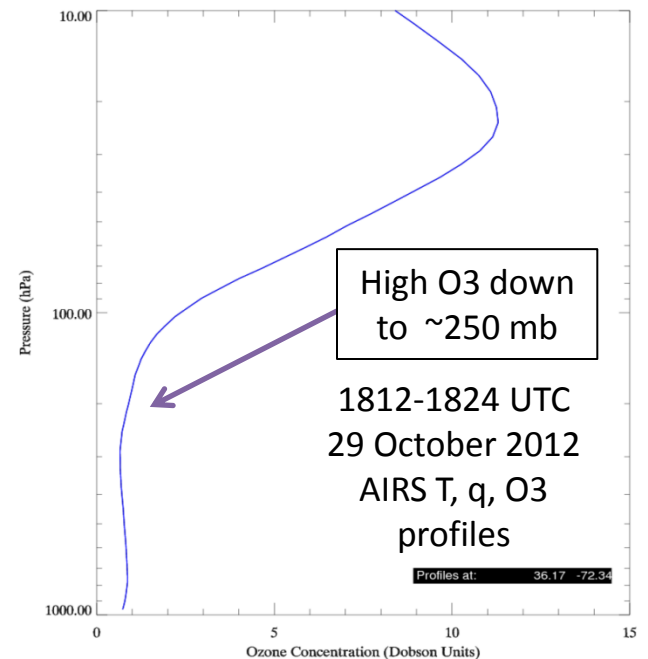


1812-1824 UTC
29 October 2012
AIRS O3
Anomaly

- Use of profiles to further validate RGB products in preparation for GOES-R ABI
- Would forecaster access to profiles/swaths on individual levels enhance confidence and interpretation of qualitative products?



Mid- &
Upper-level
Dry Air



High O3 down
to ~250 mb

1812-1824 UTC
29 October 2012
AIRS T, q, O3
profiles

Profiles at: 36.17 -72.34



Questions & Comments

Email any additional feedback or comments
emily.b.berndt@nasa.gov